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POCKET GOPHER

CONTROL

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Bulletin 23

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UNITED STATES DEPARTMENT OF THE INTERIOR
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Conservation Bulletin 23

POCKET GOPHER CONTROL

BY

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THE POCKET GOPHERS constitute a family (*Geomyidae*) of the native rodents of the United States. They are called pocket gophers because they are not only burrowers ("gophers") but also have cheek pouches in which to convey roots and other food for storage in underground chambers. In areas where these rodents are not of economic significance they should not be destroyed.

In cultivated fields, grazing ranges, forest plantations, orchards, parks, airports, and elsewhere, however, pocket gophers become important pests. In such areas, even a few are capable of serious damage, and their control is necessary. Their destructiveness consists not only in cutting roots of cultivated crops, fruit trees, and forest growth but in smothering vegetation with mounds of earth. By burrowing into embankments of water reservoirs and irrigation canals they cause costly breaks and the loss of much water. Their burrows interfere with the proper distribution of water used in irrigation and contribute to soil erosion.

Measures of control, therefore, are necessary, but because of the differing tastes and habits of the more than 100 varieties some methods that are found satisfactory in one region have no controlling effect in others. The practices here recommended are based on studies of these varying habits of pocket gophers and of environmental conditions, and are applicable wherever these rodents are found.

POCKET GOPHER CONTROL

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INTRODUCTION

WITHIN THE BORDERS of the United States are found more than 100 named and described varieties of pocket gophers, in the three genera *Geomys*, *Thomomys*, and *Cratogeomys*. These rodents occur throughout the greater part of every State west of the

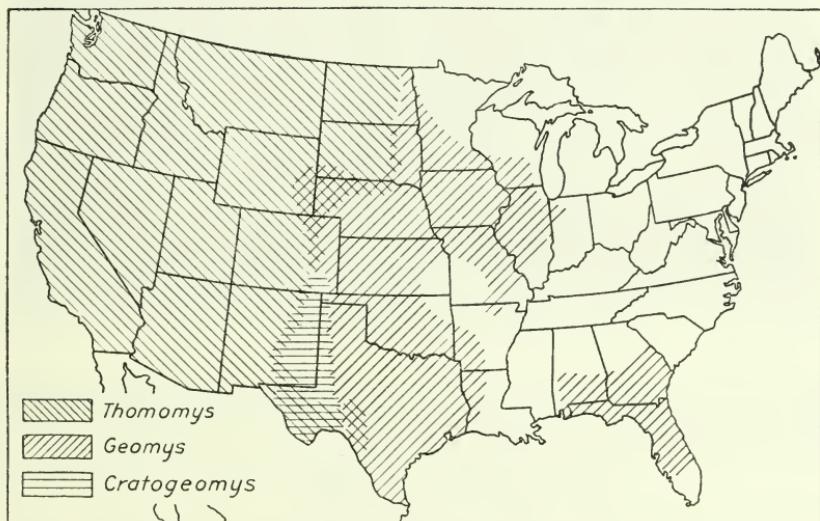


FIGURE 1.—Distribution of pocket gophers in the United States—ranges of species of *Thomomys* (west) and *Geomys* (east) overlap in a strip from Texas to the Dakotas, except where separated by *Cratogeomys* in parts of Texas, New Mexico, and Colorado.

Mississippi River and eastward over most of Illinois, southern Wisconsin, northwestern Indiana, and also in large areas in Alabama, Georgia, and Florida (fig. 1).

NAME AND STRUCTURE

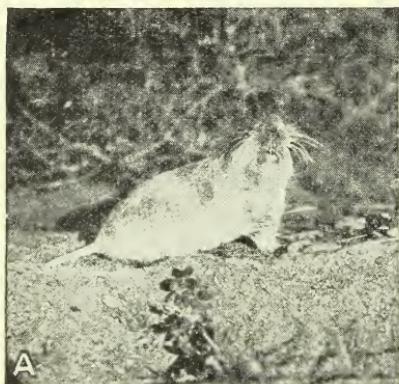
The pocket gopher is locally called salamander, pouched rat, camas rat, or merely gopher. The term "gopher" is applied also to various species of ground squirrel, and the same name is used for

NOTE.—This bulletin supersedes Farmers' Bulletin 1709, issued in 1933 by the U. S. Department of Agriculture—a contribution of the Bureau of Biological Survey, which was consolidated in 1940 with the Bureau of Fisheries to form the Fish and Wildlife Service, U. S. Department of the Interior.

a burrowing land turtle, particularly in Florida. In some localities moles also are called gophers.

The true pocket gopher (fig. 2, A) is easily distinguished from the other animals to which the name of gopher is applied. It derives its name from its most outstanding characters—it is a burrowing animal and has large cheek pockets. These pockets are wholly outside the mouth (fig. 2, B), are lined with fine hair, and are used to convey food and nesting material. The pocket gopher carries on its activities mainly underground and is seldom seen on the surface by the casual observer, though there is unmistakable evidence of its activities aboveground.

The stocky body is heavy in the forward part and well built to support muscles for digging. The shoulders and arms are strong, and the hands are equipped with long, sharp claws. The body hair, although not true fur, is soft and glossy. The tail is short and



A



B

B23372 B35477

FIGURE 2.—Pocket gophers: A, Live animal aboveground; B, near view, showing cheek pouches filled with roots.

scantly haired, the ears are inconspicuous, and the eyes are small. The 2 upper and 2 lower incisors, or front teeth, are prominent and protrude outside the mouth cavity.

COLOR AND SIZE

The color of pocket gophers varies greatly, ranging from a light brown or fawn color to a dark chocolate or black. The shade differs somewhat with species and locality, and some varieties may have two or more color phases. Melanistic individuals are found, and one species, inhabiting the Oregon coastal area, is entirely black. White, or albinistic, individuals also are found, though rarely.

In general pocket gophers are much larger than field mice, and those of most species are larger than moles. There is great variation in size, the several species ranging in weight from about 4 to 18 ounces and in total length from 6 to 13 inches. In each species, however, the size is fairly uniform. The usual individual variation is noted in young animals, and generally a marked difference in size between males and females, the males being the larger.

ADAPTABILITY

Pocket gophers readily adapt themselves to changed conditions brought about by agricultural and other developments, and within their range agriculture has favored their increase and their possibilities for damage. Such crops as alfalfa and clover furnish them excellent food and harborage, since these crops are generally grown on the same land for a period of years. The extensive reclaiming of arid lands has been especially favorable to the pocket gophers. All these changes have resulted in a great increase in the numbers of these rodents in many agricultural sections, and consequently have intensified their destructiveness (fig. 3) and made control measures necessary.

The claim has been made, probably with some merit, that pocket gophers serve a useful purpose because their extensive burrowing



FIGURE 3.—Pocket-gopher mounds in alfalfa field.

B13934

aerates and drains the soil and also fertilizes it by mixing in the vegetation. This, however, is an unimportant consideration where land is under cultivation. On such an area a plow accomplishes the same end without injuring garden, field, lawn, or park.

NEED FOR CONTROL

It is chiefly through burrowing activities that pocket gophers become injurious, although in certain situations their feeding habits are also destructive to plant life. In places where their operations have no ill effects, these rodents should not be molested, as they are interesting members of the native fauna. On range areas the control of pocket gophers should be undertaken only where these rodents are so numerous as to destroy forage needed for other animals or where their burrows are a serious contributing cause of soil erosion. The varied destructive activities of pocket gophers and the losses caused thereby may be summarized as follows:

In digging burrows pocket gophers destroy plants in fields (fig. 4, A), gardens, meadows, pastures, lawns (fig. 4, B), and parks, and cover much of the growing vegetation with soil.

They cause loss of hay by throwing up mounds, which prevent close mowing and injure machinery.

They ridge the soil and denude it of vegetation, thus being a contributing cause to beginnings of soil waste by destructive erosion (fig. 5).

They destroy many fruit, nut, and forest trees by gnawing the roots.

They eat growing grain and other crops.

Palms introduced into the southern part of the United States are subject to damage by pocket gophers, the rodents not only feeding upon the roots but hollowing out the base of the trunk or tunneling spirally upward through it and making chambers in its soft interior (fig. 6).

By burrowing into reservoirs in arid sections they cause considerable waste of valuable water needed for livestock.

Their burrows admit water used in irrigation, thus interfering with its proper distribution as well as helping it wash out deep gullies on sloping land (fig. 8).

By burrowing into dams and embankments of irrigation canals they cause costly breaks and the loss of much water (fig. 7).

Pocket-gopher damage in other places includes injury to aviation fields, where the burrows and mounds become a hazard to airplane landing; burrowing in cemeteries; and interference on golf courses, particularly by raising mounds on greens and fairways.

The control of pocket gophers on irrigated areas is as important in the distribution of the water as is the leveling of the land; it is particularly important where new irrigation projects are being established. To cut down maintenance costs it would be well to eradicate this rodent from an area before water is turned on to the land and to use all means possible to keep the project free from the rodents at all times. It is also important that the animals be eliminated from areas that are being planted for reforestation.

CONTROL IN RELATION TO HABITS

Because of the wide distribution of the many races of the pocket gopher there is considerable variation in the habits of the several species, and even in those of a single species in different localities. These habits have a direct bearing on control operations, and thus the complexity of the control problem is evident. This bulletin attempts to point out these differences in habits and to describe the various control methods that have been developed to meet adequately most situations.

BURROWING HABITS

Control of pocket gophers is especially difficult because of the extent and varying depth of their burrows (fig. 9). It is not uncommon for one pocket gopher to cover an acre or more of ground with its mounds. Many single systems of runways extend more than 800 feet. These large tunnel systems are not always connected, though in many instances they are continuous.

Pocket gophers usually burrow from 4 to 8 inches below the surface, but in some localities and at certain seasons they may go to a depth of 6 feet. In the more arid and warmer sections the depth of the burrow varies with temperature of the soil. During the cooler months the tunneling is much closer to the surface than in summer. In digging the deeper tunnels the rodent may place the excavated dirt in the tunnels of a higher level. Recognition of this habit has a direct bearing on control, as there are times of the year when activity is not apparent, there being no fresh mounds on the surface. At such times a person may be led to believe that his

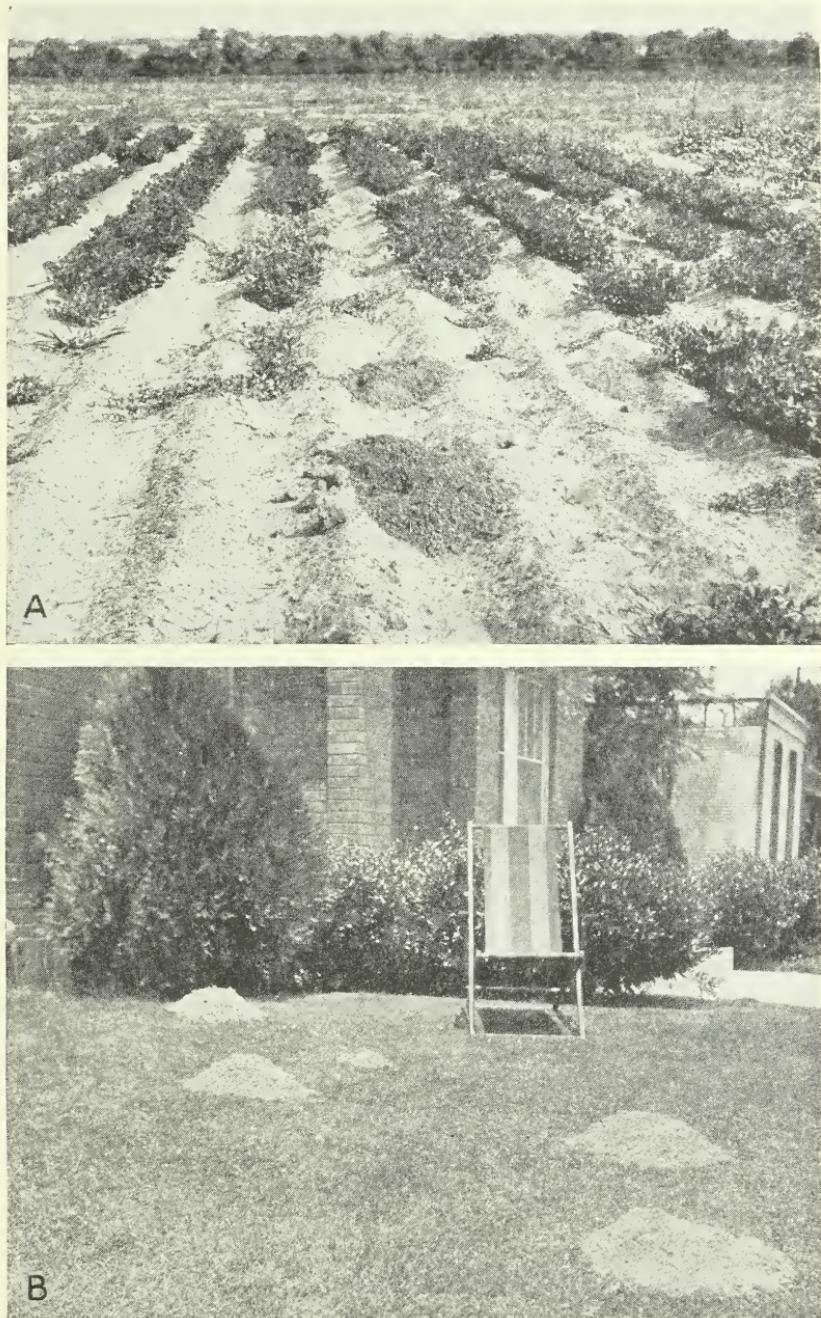


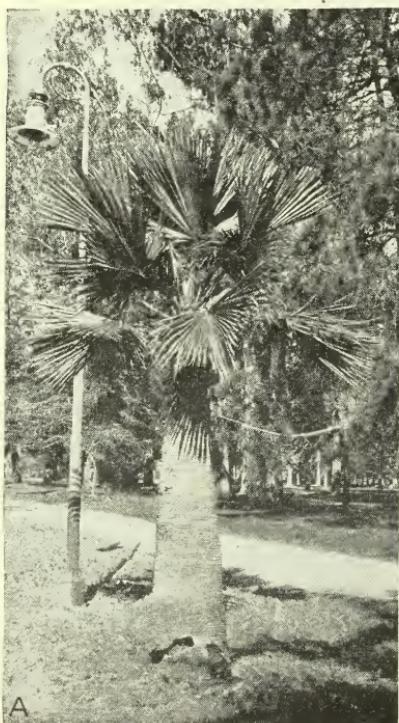
FIGURE 4.—A, Peanut field damaged by pocket gophers; B, lawn disfigured and grass killed by pocket-gopher mounds.

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B3447

FIGURE 5.—Earth forms left on the surface from pocket-gopher tunneling in the snow—a beginning cause of wasteful soil erosion during spring in most regions thus affected but at any season in mountainous country.



A



B

B34623; B34627

FIGURE 6.—A, Palm tree, with pocket-gopher tunnel in trunk exposed; B, palm, with old leaf bases removed to show interior damage by the spiral tunnel.



FIGURE 7.—A, Pocket-gopher workings in dry irrigation canal; B, water escaping from ditch through one of the burrows after it was turned into the canal; C, costly break in bank started by water escaping through pocket-gopher tunnel.



FIGURE 8.—Damage to pasture land from erosion started by irrigation water coursing through pocket-gopher burrow.

B35948

control operations have eradicated all these rodents. In placing poisoned bait he is often deceived into thinking that an active burrow has been located when the probe strikes only a loosely filled tunnel.

ACTIVE SEASONS

Generally speaking, the pocket gopher is most active at periods when the ground is not frozen very deep, or when it is not very dry, hot, and baked. In most localities the period of greatest activity is in fall, but in the Southwest this period extends from the latter part of September to the last of May. Another active period, particularly in the northern part of the United States, is during a short time in spring. The best success in control is attained during these periods of activity.

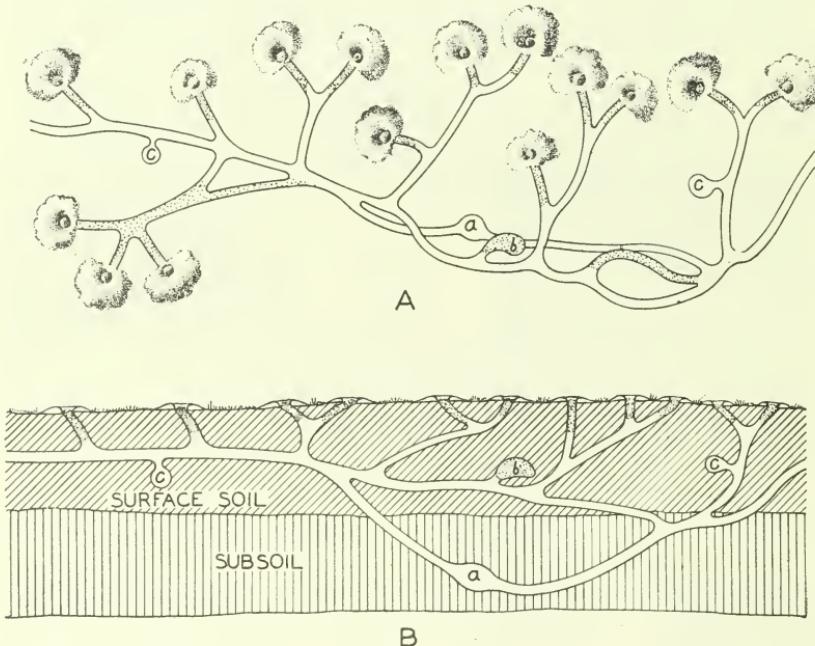


FIGURE 9.—Runway system of pocket gopher: A, Seen from above, shaded portions filled with excavated dirt; B, vertical cross section—*a*, used nest; *b*, old nest filled with dirt; *c*, store chambers for roots and other materials.

FEEDING HABITS

The food of pocket gophers is as varied as the plant life within their habitat. It consists chiefly of the roots, tubers, bulbs, and stems of plants (fig. 10), but includes also the leaves of forage plants, and small fruits and grains. The feeding habits have a direct bearing on control methods, particularly where poison is used. The most acceptable poison baits will usually be those made of food items to which the animal is accustomed. Roots and succulent green vegetation are favorites, and because of this, baits made of tuberous or root crops or of alfalfa, clover, or other fresh green vegetation are generally acceptable. The rodents obtain most of

their food underground, but it is not uncommon for them to feed on the surface, particularly in the Southwestern States. The general habit of underground feeding makes it necessary to place poisoned baits and traps in the burrows rather than on the surface.

SOCIAL HABITS

Ordinarily, except during the breeding season or when the young are being reared, a burrow will be occupied by only one animal. This is particularly the case where burrows are widely scattered and distinctly separate. Hence, in general, the destruction of a single individual in each burrow, except at breeding time or when the young are being raised, will be all that is necessary to bring about adequate control. This is not always the case, however, for often several systems of burrows are connected, and therefore this rule cannot always be applied, particularly in the Southwest, where there is a long breeding season, or on areas where there is much tunneling. Where extensive burrows are close together the tunnels may be directly connected. In such a case it is not unusual to trap or poison several individuals in the same burrow.



B27740

FIGURE 10.—Bulbs, tubers, and roots taken from a pocket-gopher store chamber.

METHODS OF CONTROL

The most common methods employed in destroying pocket gophers are poisoning, trapping, flooding, fumigating, and shooting. To accomplish adequate control a combination of two or more of these methods is often necessary.

The most practical and efficient methods are poisoning and trapping. Where control is desired over a large area in which the rodents are numerous either poisoning or a combination of poisoning and trapping should be employed. On small areas or on large tracts where there is only a small number of the rodents the use of traps alone is probably the most satisfactory method. The determination of the most efficient method to employ and the best season of the year in which to work will depend on the species of pocket gopher concerned, the degree of its activity, the locality, and the local agricultural practices.

Control operations can best be conducted during parts of the year when the pocket gophers are active, and this is usually indicated by the presence of fresh mounds of dirt. At times of less activity much

time and material may be wasted in treating unoccupied systems of runways. During fall, the season when pocket gophers are usually most active, control operations can be carried on with the least interference to growing crops, and then also the runways are more easily located. The suitability of the different methods of control under varying conditions will be treated in the discussion of these methods.

POISONING

On extensive areas heavily infested with pocket gophers poisoning is probably the least expensive and the most easily applied method of control. In many cases it is also the most effective. The danger of destroying useful birds and animals is small, since the poison baits are placed in the underground runways through openings that afterwards are closed.

The baits most commonly used are sections of sweetpotatoes, carrots, parsnips, potatoes, turnips, and beets, and their acceptability is usually in the order named. Grain baits of wheat and oats are readily taken in some localities and green baits of fresh clover or alfalfa leaves should be used in some sections of the country, particularly in the Northwest.

Pocket gophers vary in their tastes, and all individuals in the same locality may not accept the same bait. In such cases it may be necessary to re-treat an infested area, using some other material for bait. A good plan is to use sweetpotatoes for the first treatment and carrots for the second; and if necessary a third bait of grain might be exposed. In all three treatments it is necessary to bait only the runways in which there are fresh mounds. To use a mixture of several baits at one time requires a killing dose of each, and this is more expensive and less effective than to make 2 or 3 treatments with different baits.

The vegetables for baits should be thoroughly cleaned and then cut into pieces about half an inch square and $1\frac{1}{2}$ inches long. Baits 1 inch long are satisfactory for the smaller species. Some workers cut the vegetables in cubes, but, in the experience of many, better results are obtained by cutting them in long pieces. The purpose is to defeat the pocket gopher's frequent habit of storing food before eating it, and thus to insure that the poison be taken immediately. Baits cut into longer pieces are more likely to be consumed when found than they are to be stored. This has been clearly demonstrated in several experiments.

The following formulas for poisoned baits for pocket gophers are recommended:

Formula No. 1.—Root Baits

Cut into pieces $1\frac{1}{2}$ inches long and $\frac{1}{2}$ inch square-----	2 quarts sweetpotatoes or carrots.
Dust over these from a sifter (pepper box), while stirring-----	$\frac{1}{8}$ ounce strychnine alkaloid (powdered).

Mix thoroughly.

In southern Arizona and in a few other localities, this formula is modified by using 4 quarts of the bait to $\frac{1}{8}$ ounce of the strychnine alkaloid.

Formula No. 2.—Leaf Baits

Gather fresh from field, free from dew, rain, or other moisture-----	1½ pounds green clover or alfalfa leaves.
Keep free from dirt and other foreign mate- rials.	
Spread on heavy paper or put into a tight box or washtub.	
Dust over these, from a sifter (pepper box), while stirring-----	½ ounce strychnine alkaloid (powdered).
No more should be prepared than can be used in 1 day.	

Formula No. 3.—Grain Baits

Mix well-----	¾ pint water
and-----	½ ounce laundry starch.
Bring to a boil while stirring constantly.	
Cook until a paste free of lumps is obtained.	
Stir into the paste-----	¼ pint corn sirup
and then-----	½ ounce glycerine.
Mix in a 1-gallon container-----	1 ounce strychnine alkaloid (powdered)
and-----	1 ounce baking soda.
Pour the hot paste over this mixture while stirring thoroughly.	
Pour the whole mixture over-----	16 quarts wheat (plump ker- nels), or steam-rolled oats.
Stir until kernels are well coated, and then spread out to dry.	

Pocket gophers of the genus *Thomomys*, found in the western half of the United States, can generally be successfully poisoned by use of the root-bait formula (no. 1). The large Willamette pocket gopher (*T. b. bulbivorus*) in the Willamette Valley, Oreg., however, is an exception; to poison it, it is necessary to use the leaf-bait formula (no. 2) with clover leaves for bait material. For the large Townsend's pocket gopher (*T. townsendi*) in the Snake River and Boise Valleys in southern Idaho formula no. 1, or formula no. 2 with alfalfa leaves, may be used.

The large pocket gophers inhabiting the prairie States (*Geomys bursarius*) have shown a preference for grain baits, wheat being the one most generally accepted. In some areas it has been found that during the hot months of July and August steamed-rolled oats are preferred to wheat. The grain-bait formula (no. 3) may be used for this species.

LOCATING RUNWAYS

Effective methods of locating runways and placing the baits are (1) the use of a probe (fig. 11), and (2) the use of a strong garden trowel (fig. 12), shovel, or other implement made especially for the purpose. The probe method is the simpler and offers a quicker way of distributing the poison, but it does not always insure right placement. In the hands of an experienced person, however, the probe may prove as effective as the trowel.

For limited use in light sandy soil, or any soil that is not too hard, a satisfactory probe can be made of a broom, fork, or shovel handle, as shown in figure 11, A and B. One end should be bluntly pointed, and a foot rest may be attached to aid in probing. For

use in hard soil, an iron rod may be inserted at one end, as illustrated in figure 11, A, to be used as a seeker, the handle being bluntly pointed for enlarging the opening through which the bait is to be placed.

For extensive use in relatively soft soil a durable probe may be made of $\frac{3}{4}$ -inch galvanized pipe—1 piece 30 inches long, 1 piece 14 inches long, and 3 pieces each 5 inches long. The 30-inch piece is threaded at both ends and the other pieces at one end only. A piece of $\frac{1}{2}$ -inch round iron about 2 inches long is welded into the unthreaded end of the 14-inch pipe and bluntly pointed. The pieces are then arranged and fitted together with two $\frac{3}{4}$ -inch T-joints, as shown in figure 11, C.

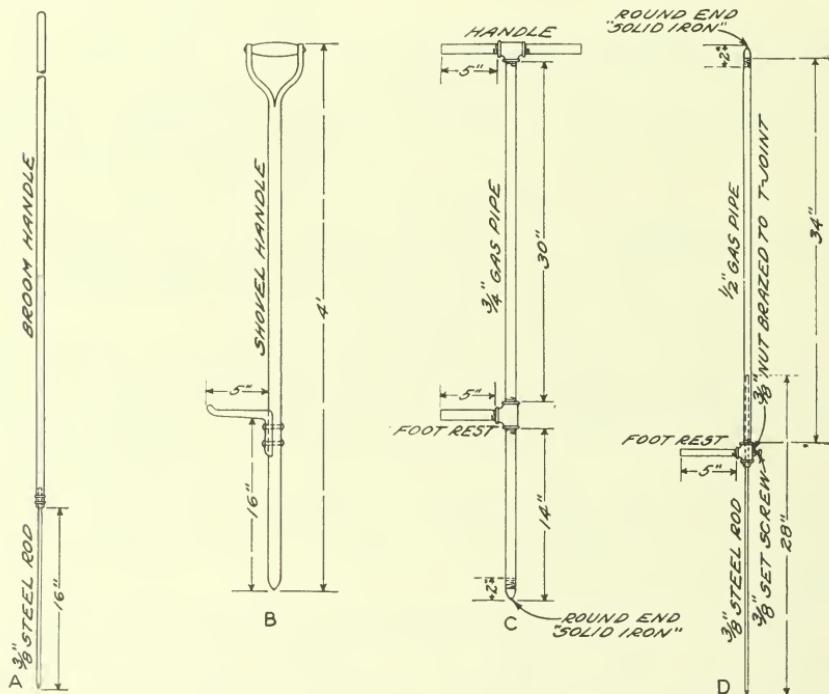


FIGURE 11.—Types of runway probes commonly used to reach burrows when trapping or poisoning pocket gophers: A, Made from broom handle and steel rod; B, from shovel handle; C, from gas pipe, for use in soft soil; D, from gas pipe with steel rod, for use in hard soil.

For use in hard soil the probe may be made of the following materials:

- 1 piece of $\frac{1}{2}$ -inch galvanized pipe, 34 inches long
- 1 piece of $\frac{1}{2}$ -inch galvanized pipe, 5 inches long
- 1 $\frac{1}{2}$ -inch galvanized T-joint
- 1 piece of $\frac{1}{2}$ -inch round iron 2 inches long
- 1 piece of highly tempered steel, $\frac{3}{8}$ inch in diameter and 28 inches long
- 1 $\frac{3}{8}$ -inch set screw, 1 inch long
- 1 $\frac{3}{8}$ -inch nut
- 1 reducer, $\frac{1}{2}$ inch to $\frac{3}{8}$ inch

The two pieces of pipe are each threaded at one end. The piece of round iron is welded into the unthreaded end of the 34-inch pipe

and bluntly pointed. A $\frac{3}{8}$ -inch hole is bored in the T joint, and the $\frac{3}{8}$ -inch nut is brazed over this hole to accommodate the set screw. The piece of highly tempered steel is sharply pointed on one or both ends and held in place by the set screw. The pointed end of a hayrake tooth cut 28 inches long would serve well for this piece. These materials are then assembled as shown in figure 11, D. The runway is located with the sharp end of the probe, and the blunt end of the probe is used to enlarge the hole to admit the poisoned bait.

In locating the runways with a trowel (fig. 12), shovel, or special implement, there can be no question as to whether the baits are placed in a clean, used main runway, but this method requires considerably more labor and time.

The location of the main runways, as viewed from the surface of the ground, may be determined in different ways. The common practice is to probe between two fresh mounds, it being taken for granted that the runway has a direct connection with the mounds. Sometimes this is the case, but not often, for the mounds are built at the mouth of the laterals and the main runways extend back

from the mounds, in some cases a comparatively long distance. Often the main runway runs in divers directions.

Another effective method, particularly after a person has had considerable experience, is to determine the main runway from the shape of the mound (fig. 13). The mound is generally somewhat semicircular or fan shaped, and usually the main runway can be located at a point between 8 and

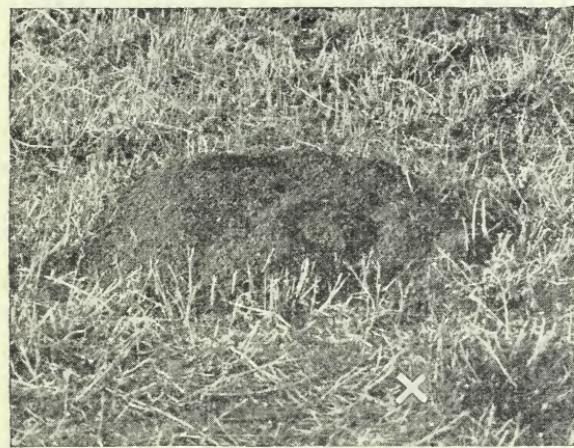


FIGURE 13.—Shape of pocket-gopher indicates where to probe for the main runway (marked X).

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18 inches from the flat side. Therefore, if one probes within about 18 inches from this side, as indicated in figure 13, he will usually locate the main runway in not more than two trials. On the steep sides of hills, ditches, roads, and the like, the burrows generally can be located at an elevation slightly higher than the mounds. When a trowel instead of a probe is employed, the same method can be

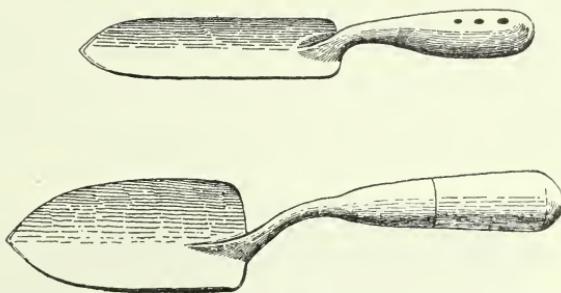
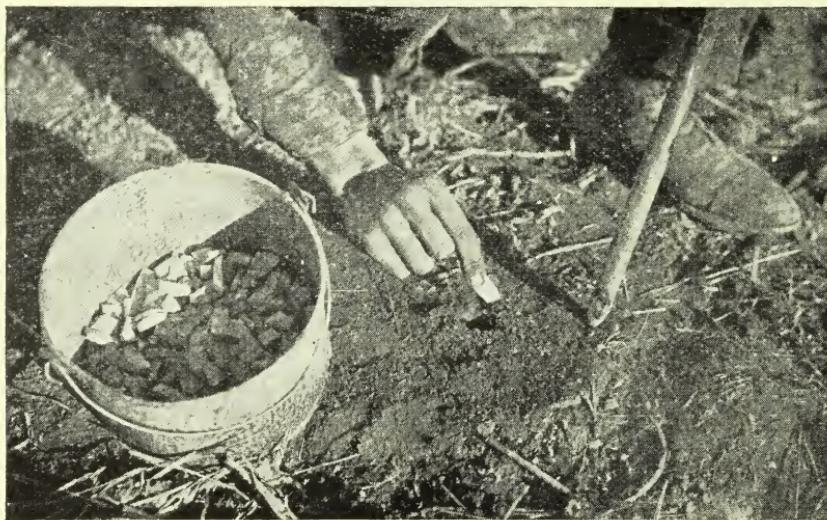


FIGURE 12.—Strong garden trowels for excavating pocket-gopher burrows in trapping and poisoning operations.

followed, but the result is different, in that when located there is no doubt whether it is the main runway. This is not always the case when a probe is used.

PLACING BAITS

After the runway is located, the bait, consisting of 2 or 3 pieces of the poisoned vegetable, a level tablespoonful of the poisoned grain, or a small handful of the poisoned green clover or alfalfa leaves, is placed in the runway through the opening (fig. 14). When the bait has been put in the runway, the hole is covered with vegetation, hard dirt, or some material that will not crumble. This in turn is covered with loose dirt. It is not good practice to use loose dirt first in covering the hole, because it may fall into the runway and cover the bait and thus render it useless.



B25595

FIGURE 14.—Dropping bait in pocket-gopher runway, through hole made with probe.

When a probe is used, care should be exercised not to make a deep depression in the floor of the runway (as illustrated in figure 15, B) because baits will drop into it and thus will not be readily found by the pocket gopher.

Each system of runways should be baited at two or more places to insure a correct placement of bait and to increase the chances that the rodent will come in contact with it. The more extensive systems should be baited at several points. It is well to level all the fresh mounds with a rake or drag a few days after poisoning, for if any pocket gophers have escaped, their fresh workings can then be readily detected. One cannot expect to destroy all the rodents with a single poisoning, and often it is well to give the infested area two or more treatments.

The success attained in poisoning depends largely on cleanliness in handling the baits and care and accuracy in distributing them. It is important that the baits be placed in a clean, used main runway;

otherwise the rodent is not likely to come in contact with them while they are acceptable. It is desirable to use fresh poisoned baits, particularly those made of roots and green leaves, as stale baits are not acceptable to pocket gophers. It is easy to place baits improperly, especially when the probe method is used. The pocket gopher's habit of filling unused runways with comparatively loose dirt contributes to this end, because the operator probing into one of these loosely filled runways receives the impression that it is the used runway. Bait placed at this point would in all probability not be visited by the rodent for some time, and perhaps not at all. Often an operator will mistake a lateral or side runway for the main runway. Baits placed in these laterals would not be effective because such runways are used chiefly for carrying dirt to the surface.

Often someone asks how to distinguish the main runway from the side runways or laterals. To answer is rather difficult, and only an experienced person can readily note the difference. If a runway is

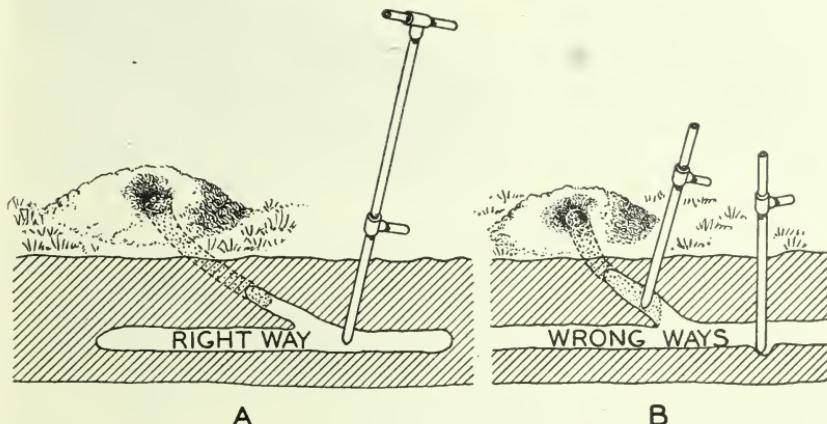


FIGURE 15.—A, Right way of using runway probe in pocket-gopher poisoning operations; B, wrong ways.

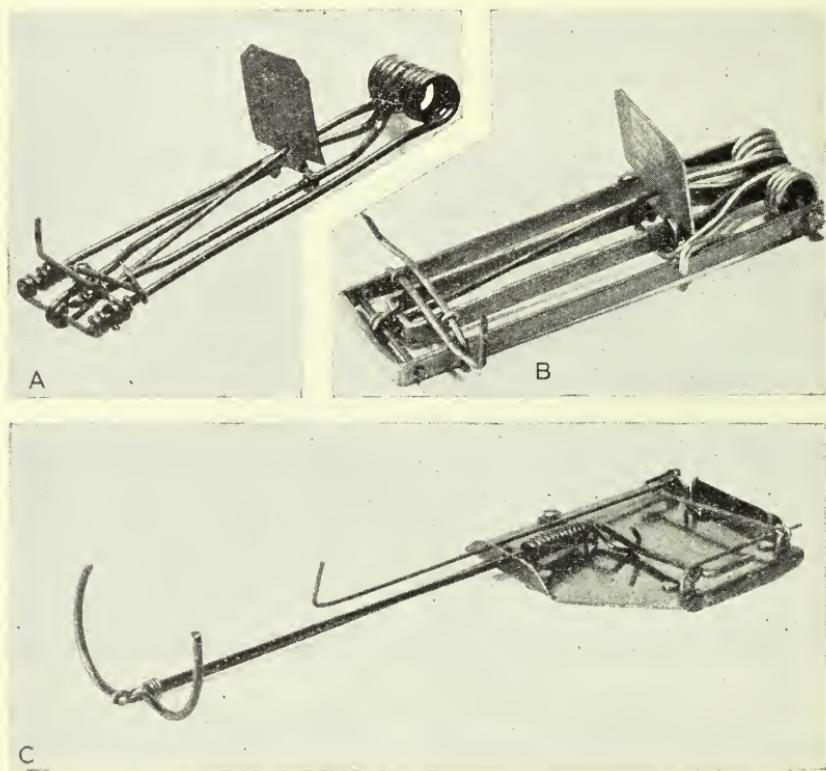
discovered 18 inches or more from the mound, however, in all probability it may be rightly considered the main one, since the laterals are usually not more than 18 inches long.

TRAPPING

Trapping is recommended for pocket-gopher control on small areas or on larger tracts with light infestations. Though slower and somewhat more expensive than poisoning, in many cases it is a surer method of ridding a farm of pocket gophers. There are several effective and inexpensive traps on the market. The types illustrated in figure 16, A and B, are adapted to most localities and have proved generally satisfactory. They are not so effective in areas inhabited by the larger species of pocket gopher, because the spread of the trap jaw is not wide enough. To take these, the type illustrated in figure 16, C, is probably the most satisfactory.

In comparison with the traps made specially for pocket gophers the common steel trap is too low in efficiency to justify its use.

In placing traps a freshly constructed mound should be selected and the burrow located nearby. The mounds are more or less fan-shaped, with the plugs of the laterals or side runways at the base. With a long-handled iron spoon or a strong garden trowel the lightly plugged opening of the lateral may be cleaned out and enlarged sufficiently to admit the trap. The setting may be in the lateral if this is long enough for the trap not to extend into the main runway, though many times it is advisable to set the traps in the main runways rather than in the laterals (fig. 17).



B611; B5172M; B1185

FIGURE 16.—Inexpensive types of pocket-gopher traps now on the market. A and B are generally satisfactory in most areas; C is best for trapping the larger species.

The main runway may be located with a probe, as described on page 13, or it may be found by digging out the lateral to its junction with the main runway. In a main runway two traps should be used, as shown in figure 17, one facing each way, so that a pocket gopher coming from either direction will be caught. (Pocket-gopher traps can be entered from only one direction.)

Traps in either a lateral or a main runway should be placed 12 to 18 inches back, and the burrow should be left open or only partly closed, as air and light bring the pocket gopher to repair the break. The trap is then sprung and the animal is caught. It is not necessary or advisable to bait the trap.

It is well to fasten the lighter traps to stakes, with a light wire or cord. A single strand of galvanized clothes-line wire is satisfactory

because it does not rust and is pliable enough to keep the trap from being tilted in the setting. If the trap is not fastened, the captured pocket gopher may escape with the trap or some animal may carry away both rodent and trap.

In order to trap a given area systematically, it is well to mark each setting by attaching a piece of cloth to the stake, or a sharpened piece of ordinary lath may be used instead. Such marking shows when the area has been thoroughly covered and also makes it easy for the trapper to locate the traps and give them proper attention.

As in poisoning to rid an area of pocket gophers, it may be necessary to supplement trapping with some other method, since a few wary individuals may be difficult to trap. As a rule, poisoning will prove effective as a follow-up.

Since there may be in the burrows a considerable number of young too small to be caught in traps, it is sometimes advisable to place

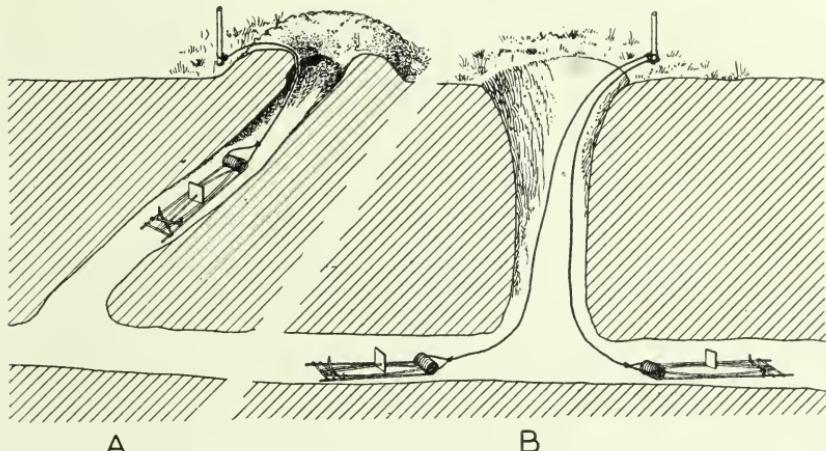


FIGURE 17.—Where to set traps for pocket gophers: A, In lateral, or side runway; B, in main runway.

poisoned baits in the runways after removing the traps. Such procedure is particularly recommended in the Southwest, where the breeding season of the pocket gopher extends over a long period.

FLOODING

In sections of the country where flooding of fields is an essential part of irrigation operations, it is sometimes possible to divert the water into pocket-gopher burrows, and thereby drive the rodents to the surface. There they can be promptly dispatched. A good dog can be trained for the purpose. Though not recommended as a generally effective method of control, flooding may be advantageously used in conjunction with irrigation operations.

FUMIGATION

Various fumigants have been tried for destroying pocket gophers, but in general they have not proved successful because the extensive and intricate burrow system does not permit adequate diffusion of the gases. Generally the burrows are close to the surface, and this

permits easy escape of the gases through the soil. Furthermore, when the rodent detects the gas, it quickly plugs the runway with dirt and thus shuts it out. Fumigants that have been extensively tried out include carbon disulphide, fumes from burning sulphur, exhaust from an automobile, and calcium cyanide. It is only in such places as wet meadows, where the burrows are short and isolated, or in canal banks, where the burrows are short and comparatively straight, that any of these gases can be used effectively.

SHOOTING

Pocket gophers are occasionally seen aboveground early in the morning and about sundown. Then they can be killed with a shotgun. Opportunities occur so seldom, however, that this method of control is not to be seriously considered.

USE OF VIRUSES

Many so-called "viruses" have been put on the market with claims that they can be effectively used in the control of pocket gophers and other rodents. It has not yet been demonstrated, however, that a virus can be employed successfully for the destruction of any rodent, and because pocket gophers are of such solitary habits, success in their control by use of a virus would seem most doubtful.

COMMUNITY EFFORT IN CONTROL

Effective control of pocket gophers requires persistent and coordinated effort throughout the community. In general, any person may easily rid his own premises by intelligent use of poison and traps, but unless the entire community unites in active and close cooperation, the area thus cleared will eventually be reinfested from adjoining lands. Careful attention must be given to all infested lands—farmed, vacant, and public. This applies particularly to waste lands along fences, streams, public highways, and railroads. Such places are favorite haunts of the pocket gopher, because the soil is easily tunneled, succulent roots furnish food, and there is usually little disturbance from cultivation. It is from such areas that adjoining cleared premises are often reinfested.

BOUNTIES

Resort to the bounty system in an attempt to bring about the community control of pocket gophers is against sound public policy—it is conducive to fraud, and it is not thorough.

It is not difficult to perpetrate fraud in claiming bounty on pocket gophers. Some public officials to whom scalps or tails are presented for bounty may never have seen a pocket gopher, and it would be practically impossible for them to distinguish a dried and shriveled pocket-gopher scalp or tail from that of any other small animal. Dishonest persons have frequently made several "scalps" or "tails" from the skin of a single animal, and a county may pay bounties on presentation of scalps or tails of pocket gophers that have been taken on areas far removed from those legally included under the plan.

After claiming bounty on the rodents that are easily captured, it becomes unprofitable to take the remainder. Consequently, consider-

able numbers are left to reproduce and reinfest the territory, and thus this drain on the public treasury continues indefinitely. Experience in many States has fully demonstrated that bounties on pocket gophers rarely bring about the desired control and that the cost of maintaining the bounty system is out of all proportion to the benefits received.

ORGANIZED OPERATIONS

Farming communities usually contain considerable areas of agricultural land held by nonresidents, as well as vacant land the owners of which are not vitally interested in destroying agricultural pests. In some regions a law requiring extermination of injurious rodents on every farm is beneficial in that it insures the destruction of pocket gophers on infested lands and compels negligent landowners to do their share in the work. Such laws usually provide for the control of pests on the initiative of the governing board of a county or township, or on petition to the board by a specified number of landowners. The work of destroying rodent pests is generally left primarily to the landowner or lessee, but if he fails to do it within the time specified, properly authorized persons may enter upon his lands, destroy the rodents, and charge the cost to his land in the form of taxes.

In some instances the desired results are accomplished by arousing the interest of all landowners through publicity and demonstrations by rodent-control experts, and by making suitable poisons and traps readily available at a low price. In many cases, however, thorough and effective community control of pocket gophers is accomplished only by employing men specially trained for the purpose and fully acquainted with the application of control methods. This system of pocket-gopher control is not always agreeable to all the landowners in the community, as some are not familiar with the procedure and its benefits and may object to persons other than themselves doing the work on their lands. The success attained within the past few years, however, in rural-community organization in various agricultural activities, particularly in pest-control campaigns, has simplified the organization of cooperative rodent-control effort in most localities. If this should not be the case in a particular pocket-gopher-infested community, it will be advisable first to organize the community without employing specially trained men. The important thing is to bring about an appreciation of the necessity for systematic and co-ordinated effort. Such effort involving the entire community can be made only after the majority of landowners have requested it and have agreed to the plan.

The expenditure of funds necessary for coordinated operations should be made mainly by a single agency. This may be accomplished by the county board appropriating funds and collecting from each landowner payment in the form of taxes under the provisions of a compulsory rodent-control law for the actual cost of treating his land, or the board may finance the work from funds raised by a special tax levy, if authorized by law. Or the finances may be provided before the work is started by assessment on private lands on a prorated basis and collection of the fund from the landowner through some existing organization or one specially formed for the purpose.

The operations should be supervised by a person well qualified by experience and training in methods of rodent control and in the organization of control activities; otherwise many mistakes are likely to be made and the project may fail through inefficient organization. The control of any rodent pest must be undertaken in a systematic and businesslike manner. In a large area it cannot be obtained by haphazard, unorganized efforts.

For directing the organization and conduct of community pocket-gopher control, the aid of rodent-control representatives either of the Fish and Wildlife Service or of State or county agencies, including agricultural extension services, is frequently available. Any community contemplating organized control of pocket gophers would do well to consult the Service's local leader of rodent control if there is one conveniently stationed in the State.

